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CALLER IDENTIFICATION QUEUE FOR WIRELESS TELEPHONES

Field of the Invention

This invention relates to a system and method for providing caller identification information to a wireless telephone for calls placed to the wireless telephone while it is out of service.

Background of the Invention

Operational characteristics of wireless telephones and wireless telephone systems and networks differ from that of wireline systems due to the transient nature of the wireless telephones. Wireless telephones are routinely out of service for a variety of reasons. For example, if the user of a wireless telephone turns the telephone off or if the wireless telephone battery lacks sufficient charge, the wireless telephone will not be capable of receiving incoming calls. Likewise, if the wireless telephone is taken out of the wireless service area, the wireless telephone will not be capable of receiving incoming calls. During such times, the user of an out of service wireless telephone may receive voice mail messages if voice mail services are provisioned on the wireless telephone, or the user of the out of service wireless telephone may simply miss the call altogether.

Wireless telephones that are provisioned for receiving caller identification information typically display the information such as the name and telephone number of the calling party and often the date and time of the call. If the user of the wireless telephone does not answer the call, or if the user of the wireless telephone is currently speaking to another caller, the wireless telephone often will receive caller identification information on the calling party and place that information in a missed call log along with an indication that a call was missed. In either case, the calling party may be routed to the voice messaging service, if any, utilized by the wireless telephone.

A problem occurs, however, when the wireless telephone is out of service. When the wireless telephone is out of service, calls placed to the telephone may be routed through to the voice messaging service of the wireless telephone, but caller identification information is lost and no missed call log is generated for calls attempted to the wireless telephone during the out of service period. Accordingly, when the wireless telephone is returned to service, the user has no indication or record of missed calls during the out of service period.

Therefore, there is a need in the art for method and system for capturing missed call information and for delivering that information to a wireless telephone when the telephone returns to service after an out of service period.

Summary of the Invention

In accordance with the present invention, the above and other problems are solved by a method and system for collecting and storing caller identification information associated with a calling party directed to an out of service wireless telephone. When calls are made to a wireless telephone, a determination is made as to whether the telephone is registered for service, that is, whether the telephone can receive calls because it is powered on and is located within a wireless telecommunications service area where it may receive calls. During out of service periods, caller identification information on calls placed to the wireless telephone is stored in an identification queue. Once the wireless telephone is registered for service, stored caller identification information is forwarded to the wireless telephone for presentation to the user of the wireless telephone. Accordingly, the user of the wireless telephone avoids missing telephone calls made to her wireless telephone during the out of service period, and the user may then return the telephone calls at a convenient time.

These and other features and advantages, which characterize the present invention, will be apparent from a reading of the following detailed description and a review of the associated drawings. It is to be understood that both the foregoing general description and the following detailed description are exemplary and explanatory only and are not restrictive of the invention, as claimed.

Brief Description of the Drawings

Figure 1 is a pictorial diagram representing the system architecture of an exemplary embodiment of the present invention.

Figure 2 is a block diagram of a telecommunications network illustrating an exemplary operating environment for the present invention.

Figure 3 is a flow diagram illustrating a method for capturing missed call information and delivering that information to a wireless telephone.

Detailed Description of the Preferred Embodiment

The following description of an exemplary embodiment of the present invention is made with reference to the above-described drawings wherein like numerals refer to like parts or components throughout the several figures. The present invention is directed toward a method and system for collecting and storing caller identification information associated with a calling party directed to an out of service wireless telephone. Once the wireless telephone is registered for service where the wireless telephone is powered on and is located within an operational wireless telecommunications service area, stored caller identification information on calls received during the out of service period is forwarded to the wireless telephone for presentation to the user of the wireless telephone. Accordingly, the user of the wireless telephone avoids missing telephone calls made to her wireless telephone during the out of service period, and the user may then return the telephone calls at a convenient time.

Figure 1 is a pictorial diagram representing the system architecture of an exemplary embodiment of the present invention. When a calling party utilizing a landline telephone 21 or a wireless telephone 54 places a call to a wireless telephone 55, as illustrated in Figure 1, a determination is made at a home location register 56 of the wireless telecommunications service provider for the wireless telephone 55 as to whether the telephone 55 is registered for service. The wireless telephone 55 is registered for service if the telephone is on and is within the service area for receiving calls. That is, if the wireless telephone is switched off, or if the telephone is off due to a dead battery or other malfunction, the home location register will register the telephone

as out of service. Likewise, if the telephone has been moved to an area outside the wireless telecommunications service provider area, or if wireless signaling to the wireless telephone 55 has been temporarily interrupted or obstructed, the home location register (HLR) 56 will register the wireless telephone 55 as out of service.

If the wireless telephone 55 is registered for service, the telephone call placed to the wireless telephone 55 is routed to the wireless telephone according to well known call routing procedures in a wireless telephone communications network. An exemplary wireless telecommunications operating environment is described in detail below. It should be understood that if the wireless telephone 55 is provisioned with caller identification services, caller identification information on the calling party will be provided to the wireless telephone 55 with the call. On the other hand, if the wireless telephone 55 is registered as out of service by the HLR 56, caller identification information on the calling party is forwarded to an identification queue (IdQ) 58 for storage.

As soon as the wireless telephone 55 is returned to service, where the telephone is switched to the on position or where the wireless telephone is returned to an operational service area, signaling between the wireless telephone 55 and the HLR 56 causes the wireless telephone to be registered for service by the HLR 56. Once the wireless telephone 55 is registered for service, stored caller identification information on calls missed by the wireless telephone 55 during the out of service period are forwarded to the wireless telephone 55 for presentation to the user.

Exemplary Operating Environment

It is advantageous to describe an exemplary operating environment in which the current invention may reside. Fig. 2 is a block diagram illustrating components of a telephone network that provides an exemplary operating environment for the present invention. Referring now to the drawings, in which like numerals represent like elements throughout the several figures, aspects of the present invention and the advanced intelligent network (AIN) and an integrated wireless network will be described.

The modern public switched telephone network (PSTN) has separate signaling paths for voice signals (or other customer-utilized communication circuits) and for control signals, which include information transmitted throughout the network to control the connection and disconnection of the voice circuits. The public switched telephone network that evolved in the 1980s incorporated the advanced intelligent network (AIN). Some of the components of the advanced intelligent network are illustrated in Fig. 2. Fig. 2 is a block diagram representing at least a part of the advanced intelligent network (AIN) 100 of a typical local exchange carrier integrated with components of a wireless network 150. The advanced intelligent network (AIN) uses the signaling system 7 (SS7) network for signal or system control message transport. The components thereof are well-known to those skilled in the art. The operation of many of the components of the advanced intelligent network is also described in U.S. Pat. No. 5,245,719 to Weisser entitled "Mediation of Open Advanced Intelligent Network Interface by Shared Execution Environment" which is incorporated herein by reference. The SS7 communications protocol is provided in the document entitled "Bell Communications Research Specification of Signaling System 7," Document TR-NWT-000246, Issue 2 (June 1991), plus Revision 1 (December 1991), which is also incorporated herein by reference.

A plurality of central offices are provided in a typical public switched telephone network. As shown in Fig. 2, each central office may include an electronic switch known to those skilled in the art as a service switching point (SSP). These are indicated in Fig. 2 as SSP switches 12 and 14. The number of SSP switches depends on the number of subscribers to be served by the public switched telephone network. An SSP is the AIN component of a typical electronic central office switch used by a local exchange carrier. The terms "SSP" and "switch" are used interchangeably hereinafter and are understood to refer to a telecommunications switch having AIN capability and which may be utilized for connecting voice channel circuits, including voice channel lines, such as trunk circuits 30 and 32.

As shown in Fig. 2, central offices switches (SSP) 12 and 14 have a plurality of subscriber lines 18 and 20 connected thereto. Each of the subscriber lines

18 and 20 is connected to a terminating piece or pieces of customer premises equipment that are represented by telephones 21 and 24. SSP switches 12 and 14 are connected by a plurality of trunk circuits 30. These are the voice path trunks that interconnect the central offices 12 and 14 and over which calls are connected when completed.

Each piece of terminating equipment in the PSTN is preferably assigned a directory number. The term "directory number" is used herein in a manner consistent with its generally understood meaning of a number that is dialed or input by an originating party at an originating station to reach a terminating station associated with the directory number. A directory number, typically a ten digit number, is commonly referred to as a "telephone number" and may be assigned to a specific telephone line, such as the telephone line 18 shown in Fig. 2.

Much of the intelligence, and the basis for many of the enhanced features of the network, resides in the local AIN service control point (SCP) 42 that is connected to signal transfer point 34 via SS7 data link 44. As is known to those skilled in the art, AIN service control points, such as SCP 42, are physically implemented by relatively powerful fault tolerant computers. Among the functions performed by the service control points is maintenance of network databases used in providing enhanced services. Service control points, such as SCP 42, normally implement high volume routing services, such as call forwarding and 800 number translation and routing. They are also used for maintenance of and providing access to high volume databases for authorization of billing, such as credit card number validations. In most local exchange carrier networks, service control points are only used for data base look up and routing services that take place prior to the logical completion of the call, i.e., the provision of a ringing signal to the called subscriber line and ring back to the calling subscriber.

Additional devices for implementing advanced network functions within the AIN 10 are provided by regional STPs (not shown), regional SCPs (not shown), and a service management system (SMS) 46. The STP 34 is connected to the SSPs via connections 36, 38 and 40. Both the regional SCPs and the local SCP 42, which represent a plurality of local SCPs distributed throughout the AIN 10, are connected via respective data links to the SMS 46. The SMS 46 provides a centralized platform for

remotely programming the various SCPs of the AIN 10 so that a coordinated information processing scheme may be implemented for the AIN 10. The SMS 46 is implemented by a large general purpose computer and interfaces to business offices of the local exchange carrier and interexchange carriers. SSPs download, on a non-real time basis, billing information to a billing system 50 that is needed in order to appropriately invoice subscribers for the services provided.

The SCP 42 is also connected to a caller name (CNAM) database 48. The CNAM database comprises a plurality of directory numbers along with associated names for the directory numbers. The CNAM database may be used to provide a look-up database to provide caller ID service. The CNAM database may comprises directory numbers from wireline customers as well as wireless customers of wireless network 150.

In operation, the intelligent network elements of the AIN 100, as described above, communicate with each other via digital data messages transmitted over the network of digital data links. An SSP may be configured to interface with these network elements through the use of a trigger. A trigger in the network is an event associated with a particular subscriber line or call that causes the SSP to generate a data packet message to be sent to a service control point. In order to keep the processing of data and calls as simple and generic as possible at central office switches, such as SSP central office switches 12 and 14, a relatively small set of triggers are defined at the SSP central office switches for each call.

The message created by an SSP in response to a trigger is known as a "query" message. A query message opens a "transaction" and the SSP generally holds the communication until it receives a reply from an appropriate network element via the network of digital data links instructing the SSP 12 to take a certain action. If the SSP 12 receives no instructions within a certain amount of time, the SSP "times-out" and executes a default task for the communication. The reply to the query message may be a "conversation" message or a "response" message. Conversation messages allow for bi-directional exchanges between network elements while the transaction remains open. A "response" message closes the transaction opened by the query

message, and usually instructs the SSP to route the held communication for connection with a terminating station. Query messages, conversation messages, and response messages are standard types of messages defined by the AIN protocol. The details of the AIN protocol are well-known to those skilled in the art and will not be further described herein. For more information regarding the AIN protocol, see Bellcore Specification GR-1298-CORE Switching Systems Generic Requirements for AIN 0.1, which is incorporated herein by reference.

The wireless network 150, such as a cellular network, comprises a mobile switching center (MSC) 52. The MSC 52 is a switch providing services and coordination between wireless user in network 150 and external networks. The MSC 52 may be connected to STP 34 to provide information to the wireline network and receive information from the wireline network. The MSC 52 also communicates with a wireless subscriber, such as wireless telephones 54 and 55. For preparation of billing, the MSCs create call detail records (CDR) similar to the above-described AIN SSPs. The call detail records created by the MSCs are transmitted to the billing system 50 for preparation of periodic wireless subscriber billing.

The signaling protocol used between the components of the wireless network 150 is well known to those skilled in the art. An exemplary signaling protocol is the interim standard 41 (IS-41). The IS-41 standard defines the processed by which wireless provider accomplish signaling between the MSCs and other devices for purposes of intersystem handoff and automatic roaming. For purposes of caller identification information, as described with reference to an exemplary embodiment of the present invention, the IS-41D standard is utilized to address various features such as calling name ID, enhanced 911, and law enforcement intercept. Operation of the IS-41 signaling protocols is well known to those skilled in the art.

The MSC 52 may also be connected to a home location register (HLR) 56. The home location register 56 is a wireless telecommunications component. The HLR 56 is a permanent SS7 database used in cellular networks including the advanced mobile phone system, the global system for mobile communications and the PCS or personal communications system. The HLR 56 may be located as a separate component

as illustrated in Figure 2, or the HLR 56 may be resident on the SCP 42 of the cellular provider of record. The HLR 56 may be used to identify and verify a subscriber, including caller identification information such as name and wireless telephone number of the subscriber. The HLR 56 also contains subscriber data related to features and services subscribed to. The HLR 56 is used not only when a call is being made within an area of coverage supported by a given wireless provider, it may also be used to verify the legitimacy and features subscribed to by a given use when the user is roaming outside that area. Under roaming conditions, a local service provider may query the HLR 56 of another wireless telecommunications service provider via an SS7 data link. Once information on the subscriber is verified. Data on the subscriber may be transferred via the SS7 line to the HLR 56 of the local service provider in which the subscriber is roaming.

According to an exemplary embodiment of the present invention, the IdQ 58 or identification queue is a database used in accordance with the present invention for storage of caller identification and related information for subsequent transmission to a wireless telephone 55 after the wireless telephone is registered for service. As should be understood by those skilled in the art, the IdQ 58 may be any suitable form of electronic memory medium for storage and retrieval of caller identification and related data. The IdQ 58 is illustrated in Figure 2 as a stand alone memory device. As should be understood by those skilled in the art, the IdQ 58 may be resident on the HLR 56, or the IdQ 58 may be resident on another telecommunications component such as the SCP 42.

Operation of an Exemplary Embodiment

Having described an exemplary operating environment and the system architecture of the present invention with reference to Figures 1 and 2, Figure 3 is a flow diagram illustrating a method for capturing missed call information and delivering that information to a wireless telephone when the wireless telephone is in service after an out of service period. The method 300 is described with reference to Figures 1-3, and for purposes of the exemplary call flow, assume that a wireless telephone services

subscriber operates a wireless telephone 55 on which the subscriber receives caller identification information on calling parties.

The method 300 begins at step 305 and proceeds to step 310 where a call is placed to the wireless telephone 55 from a wireline telephone 21. It should be understood that the call flow described herein is equally applicable to a call initiated from a wireless telephone 54 to a wireline telephone 55. Any differences between call processing of a call directed to a wireless telephone from a wireline telephone versus a call directed to a wireless telephone from a wireless telephone are well known to those skilled in the art.

At step 315, a determination is made as to whether the wireless telephone 55 of the called party is provisioned with caller identification services. As is well known to those skilled in the art, this determination may be made at the SCP 42 by determining features applicable to the telephone line of the called party based on the digits dialed by the calling party. According to the present example, where the telephone call is made to the wireless telephone 55, the features provisioned on the wireless telephone 55 may be determined by checking the features of the wireless telephone 55 at the HLR 56.

If at step 315 a determination is made that the wireless telephone 55 is not provisioned with caller identification services, the method proceeds along the "NO" branch to step 335 and the telephone call is delivered to the wireless telephone 55, and the process ends at step 360. However, if at step 315 the determination is made that the wireless telephone 55 is provisioned with caller identification services, the method proceeds to step 320, and the caller identification information of the calling party is determined. According to an exemplary embodiment, if the calling party is calling from a wireline telephone 21, the caller identification information may be located in the CNAM 48 database through the SCP 42. If the calling party is calling from a wireless telephone 54, the caller identification information may be obtained from the CNAM 48 database or the information may be obtained from the HLR 56.

At step 325, after the caller identification information is obtained for the calling party, a determination is made as to whether the wireless telephone 55 of the

called party is registered for receipt of a call. As described above, the wireless telephone 55 will be registered for receipt of a call if the telephone is on and is located within a wireless service area where calls may be routed to the wireless telephone 55. At step 325, a query may be routed from the central office 12 of the wireline telephone 21 to the SCP 42 for a determination as to whether the wireless telephone 55 of the called party is registered for service. Based on the digits dialed by the called party, the SCP 42 may transmit an IS-41 location request to the HLR 56 to obtain the registration status of the wireless telephone 55. If the call originates from a wireless telephone 54, the query for the status of the wireline telephone 55 may be directed from the MSC 52 to the HLR 56 using the IS-41 signaling protocol.

If the information contained in the HLR 56 indicates that the wireless telephone 55 is in service and ready for receipt of the call, the method proceeds along the "YES" branch to step 330, and the caller identification information is forwarded to the wireless telephone 55. At step 335, the telephone call is delivered to the wireless telephone 55. As should be understood by those skilled in the art, the user of the wireless telephone 55 may answer the telephone, not answer the telephone, or the user may be speaking with another party on the wireless telephone 55. In either case, according to an exemplary embodiment, the caller identification information will be provided to the wireless telephone 55 for presentation to the user of the wireless telephone 55 or for storage in a missed call log of the wireless telephone 55.

Returning back to step 325, if the information contained in the HLR 56 indicates that the wireless telephone 55 is not registered for service, for example, the wireless telephone 55 is turned to the off position, contains a dead battery, or is outside the service area of the wireless telephone 55, the method proceeds along the "NO" branch to step 340. At step 340, an IS-41 message containing the caller identification information for the calling party is forwarded to the IdQ 58 for storage. Caller identification information stored at the IdQ 58 is stored in the order it is received. As should be understood, a number of calls may be place to the wireless telephone during any out of service period.

At step 345, a subsequent IS-41 message is sent to the HLR 56 to determine the registration status of the wireless telephone 55. At step 350, a determination is made as to whether the wireless telephone 55 is registered for service, as described above. If the wireless telephone 55 is still out of service, the method proceeds along the "NO" branch back to step 345 at a regular frequency to check the registration status of the wireless telephone 55. It should be understood that signaling between the wireless telephone 55 and the HLR 56 continually updates the status of the wireless telephone 55. That is, when the telephone is on and in a service area in which it is registered to operate, the telephone periodically signals the HLR 56 to maintain its location and operational status updated with the HLR 56.

At step 350, if the wireless telephone 55 is now registered for service, the method proceeds along the "YES" branch to step 355. At step 355, all saved caller identification information for any calls missed by the wireless telephone 55 during the out of service period are forwarded to the wireless telephone 55. Depending on the wireless telephone model, the user may receive a missed calls message directing the user to a missed calls log where the user will find a listing of all telephone calls missed during the out of service period including the caller identification information for each of the missed calls. According to a preferred embodiment, the caller identification information is listed in the order in which calls were received. As should be understood by those skilled in the art, other information may be provided including the date and time of the missed calls. Accordingly, the user of the wireless telephone 55 may now return all missed calls directed to her wireless telephone 55 during the out of service period.

As should be understood by those skilled in the art, the foregoing call process description is applicable to situations in which the called party is roaming relative to his or her home wireless service provider area. In the case of a roaming called party, the SCP of the local service provider queries the HLR in the roaming service area via an SS7 data link. Once the legitimacy and identification of the roaming called party are determined, all information from the called party's home service area HLR 56 including caller identification information and registration status may be

forwarded to the called wireless telephone 55 located in a roaming wireless telephone service area via the SS7 data links from the HLR 56 to an HLR of the roaming wireless telephone service area.

As described, a system and method are provided for capturing and delivering caller identification information for calls directed to a wireless telephone during periods in which the wireless telephone is out of service. It will be apparent to those skilled in the art that various modifications or variations may be made in the present invention without departing from the scope or spirit of the invention. Other embodiments of the invention will be apparent to those skilled in the art from consideration of the specification and practice of the invention disclosed herein.